Remarks

Claims 1-16 are pending in this application. Claims 1-3, 10, 11, 13 and 15 have been amended to more clearly define the invention. Claim 1 has been amended to remove reference to the grouped materials in the continuous tube. Claims 2, 3 and 15 have been amended to reflect the amendment to claim 1. Claims 10 and 11 have been amended to remove the antecedent basis issue noted in the Office Action relating to "the wall." This feature is disclosed in the specification on page 5, line 34 to page 6, line 2. Claim 13 has been amended to address a typographical error. No new matter is being added by any of such amendments.

Rejection of Claims 10 and 11 under 35 U.S.C. §112

Claims 10 and 11 were rejected as being indefinite because of an antecedent basis issue with regard to "the wall." In response thereto, Applicant has amended each claim to refer to "a wall" and submits that such amendment overcomes the indefiniteness issue.

Rejection of Claims 1, 4, 6 and 10-13 under 35 U.S.C. §103(a)

Claims 1, 4, 6 and 10-13 have been rejected as being obvious over Hille et al. (US 5,678,806). Applicants respectfully traverse this rejection because the reference fails to teach each and every limitation of the claimed invention and there is no motivation or suggestion in Hille et al. to make a modification of Hille et al. to arrive at the claimed invention.

The object of the present invention is to provide a cooling panel with improved properties relating to mechanical and thermal stresses and having a longer service lifetime than conventional cooling panels. This is accomplished by casting copper around a tube which has sufficient mechanical strength and fatigue properties, such as a high Ni and Cu containing tube,

and to provide the cooling panel with ribs which extend only over part of the width of the cooling so as to reduce mechanical and thermal stress.

Conversely, the object in Hille et al. is to provide a system of cooling plates which, when assembled into a cooling panel, also removes heat from the transition area between neighboring cooling plates. The system "consists of copper plate coolers in which copper plate coolers arranged vertically next to each other or horizontally on top of another are arranged so densely in the interior of a shaft furnace that the heat is removed uniformly, even in the transition of the plate coolers." See Hille et al. col. 2, lines 13-18. The system of Hille et al. consists of at least a first and second cooling plate, wherein the first cooling plate has flanges extending from the body of a first type of cooling plate which flanges are not provided with webs and grooves. See Hille et al. FIGS. 1 and 2. The second cooling plate has flanges extending from the body of a second type of cooling plate which flanges are provided with webs and grooves. See Hille et al. FIGS. 3 and 4. After mounting of the plates in a blast furnace, the flanges of both types of cooling plates overlap such that the system of cooling plates shows a continuous pattern of webs and grooves. The portion of the plate cooler facing the inside of the furnace has ribs extending from the surface of the plate cooler. See Hille et al. FIGS. 1-4.

The plate coolers of Hille et al. are made of a forged ingot or rough rolled ingot. See Hille et al. Field of Invention and claim 1.

Furthermore, in the plate cooler of Hille et al., cooling channels are provided. These cooling channels are manufactured by drilling or similar techniques, but are not formed by internal tubes of a material different from the material of the rest of the plate.

Based on these descriptions of the present invention and the disclosure of Hille et al., Hille et al. discloses a plate cooler system distinct from the cooling panel of the present

invention. With respect to the Office Action, Hille et al. cannot render obvious the claimed invention because Hille et al. fails to teach each and every feature of the claimed invention.

For example, claim 1 has the feature of a "continuous tube made from an alloy which predominately comprises Cu and Ni with a Ni content of $\geq$ 28% by weight." Hille et al. does not disclose the use of any alloy containing nickel, nor does Hille et al. disclose or teach of using different materials for the plate and the tubing within the plate. The plate coolers in Hille et al. are made of a forged or rough rolled ingot. See Hille et al. col. 2, lines 25-27. Cooling channels are provided in the cooling plates. See Hille et al. FIGS. 1-4. These channels are manufactured by drilling or similar techniques, but are not formed by internal tubes of a material different from the material of the rest of the cooling plate. Based on such disclosure, Hille et al. also does not teach of such features or suggest its own modification to arrive at such features. Such readings would be beyond the disclosure of Hille et al.

Claim 1 also has the feature that the "remainder of the cooling plate consists of copper which is cast around this tube." Hille et al. fails to disclose this feature as well. Hille et al. discloses making the plate cooler of a forged or rough rolled ingot (See col. 2, lines 25-27) and only teaches of deep drilling cooling lines in reference to a German Patent (See col. 1, lines 33-37), but does not disclose or teach of casting the cooling plate around the cooling lines.

Claim 4 has the feature wherein the "ribs have a length, in the width direction of the cooling panel, which is smaller than the width of the cooling panel." Hille et al. fails to disclose or teach this feature as well. In appears the Office Action was relying on flanges 5, 7 in FIG. 2 of Hille et al. However, as stated in col. 4, lines 37-39 of Hille et al., "[v]ertical side flanges 5 are arranged to the side of the cooling body 3, and horizontal side flanges are arranged above and under the cooling body." The plate coolers of have ribs extending over the entire width of the

cooling panel, i.e., over the full width of the cooling surface of the first type and even beyond of the cooling surface of the second type. See Hille et al. FIGS. 5 and 6. The ribs of Hille et al. are meant to carry a refractory lining (See col. 4, lines 57-59) and consequently, the ribs are not in direct contact with the hot burden of a furnace. For that reason, the mechanical and thermal stress on the ribs is low. Therefore, Hille et al. uses ribs extending over the full width of the cooling panel. Different therefrom, the ribs according the claimed invention are suitable to be used without a thermal lining and the thermal stress on the ribs is high. By having a plurality of short ribs, next to one another, thermal and mechanical stress can be reduced. See Specification page 3, lines 7-10.

Hille et al. is not concerned with thermal or mechanical stress or service life of the cooling panel and does not contain any hint how such stress can be prevented or at least how the consequences or stress can be reduced or completely avoided. Also, Hille et al. does not refer to casting in tubes of a composition of amended claim 1.

Claim 10 has the features wherein "a wall is provided, on the side of the connection ends, on either side of each duct, with undulating recesses in which reinforcing walls which fill up these recesses are distributed over the height of the cooling panel" and claim 11 has the feature wherein "a wall, on the side remote from the connection ends, is provided, on either side of each duct, with undulating recesses." Hille et al. also fails to disclose or teach this feature as well. The walls on the connection side or opposite the connection of the plate cooler of Hille et al. are flat surfaces without any undulations. Such features are beyond the disclosure of Hille et al.

Therefore, because Hille et al. fails to disclose or teach the features of claims 1, 4, 10 and 11 and further fails to provide a suggestion or motivation to modify its plate coolers to arrive at

these claims, Hille et al. fails to render these claims and any claims depending therefrom, i.e., claims 1-16, obvious.

Rejection of Claims 5-9 under 35 U.S.C. §103(a)

Claims 5-9 have also been rejected as being obvious over Hille et al. (US 5,678,806) based on the presumption that the shapes of each ribs as claimed is a known "prior art component." Applicants respectfully traverse this rejection because the reference fails to teach the rib designs as claimed and Hille et al. provides no motivation or suggestion to modify itself to arrive at the claimed invention, nor has the Examiner provided evidence that such modification is obvious to one of ordinary skill in the art.

Regarding claim 5, the claimed invention has the feature wherein "the ribs have a length in the width direction of the cooling panel of $\leq$ 50% of the width of the panel." As mentioned above with respect to claim 4, Hille et al. fails to disclose or teach such feature because it teaches of the ribs extending the full width of the plate cooling panel. Such argument applies equally to claim 5. The same argument also applies to the rejection of claim 16 wherein the cooling panel is $\leq$ 25% of the width of the panel.

Claim 6 has the feature wherein "the ribs are provided with supporting backs." Claims 7, 8 and 9 disclose further features relating to the rib design of claim 6. Hille et al. fails to disclose or teach of these features. In the entire disclosure of Hille et al., the plate coolers merely have elongated ribs extending the length of the plate cooler panels, there is no disclosure of any supporting backs nor is there any teaching or motivation to alter the ribs to provide any supporting backs.

The Office Action has taken the position that modifications of rib designs of cooling panels in furnaces are well known in the art; however, the Office Action has not provided any evidence other than this blanket statement to support this position. If the Office Action is to maintain this position, the Applicants respectfully request the Office to substantiate this assertion with prior art evidence showing these modifications of ribs in cooling panels.

Rejection of Claims 1-16 under 35 U.S.C. §103(a)

Claims 1-16 have been rejected as being obvious over Hille et al. (US 5,678,806) as applied to claims 1 and 5-9 above in view of the McKoon article (A COMPARISON OF THE HEAT TRANSFER CAPABILITIES OF TWO MANUFACTURING METHODS FOR HIGH HEAT FLUX WATER COOLED DEVICES) or in view of MacRae (US 6,280,681).

Applicants initially traverse the rejection on the basis that MacRae is not a proper reference. MacRae has a filing date of June 12, 2000 and an issuance date of August 28, 2001. Applicants' application has a constructive invention date of April 20, 1999 and earliest US filing date is April 13, 2000, based on the filing of its parent PCT application. Thus, MacRae does not qualify as a reference under any section of 35 USC §102.

Applicants submit McKoon fails to make up for the deficiencies of Hille et al. outlined above with respect to claims 1 and 5-9. Moreover, Applicants traverse the rejections of claims 2, 3 and 15 based upon the combination of Hille et al. with McKoon because there is no suggestion or motivation to make such a combination. As mentioned above, Applicants' invention provides a cooling panel with improved properties relating to the mechanical and thermal stresses and having a longer service lifetime than conventional cooling panels.

On the other hand, McKoon relates to a comparison of the heat transfer characteristics of water-cooled copper devices manufactured via conventional drilled passage construction and via a technique whereby molten copper is cast over a network of preformed cooling tubes. The test for the comparison was done to assess the suitability of the latter embodiment for use as a crucible to hold partially solidified metal. This use of cast copper crucibles is distinct from the cast copper cooling elements for a shaft furnace.

Furthermore, McKoon concludes the heat transfer characteristics of the cast copper cooling elements having cast-in tubes is inferior to the cooling characteristics of a copper plate having drilled holes as passages for the cooling fluid. This conclusion discourages experiments with a cast copper cooling element with cast-in tubes for application for cooling where high cooling capacity is required, for example in a blast or shaft furnace. Thus, it is respectfully submitted that McKoon teaches one having ordinary skill in the art away from using cast-in tubes, which are made of Monel in the experiment of McKoon.

Regarding claims 4 and 10-13, Applicants traverse this rejection for the same reasons as outlined above with the single reference rejection of the same claims over Hille et al. and further submit that McKoon fails to make up for the deficiencies noted.

Claim 14 presents a process for producing the panel having the features outlined in claim 2. Nowhere in the Office Action is a discussion outlining which features of either Hille et al. or McKoon provide a disclosure for or a teaching of the features contained in such claim. Additionally, Applicants submit Hille et al. and McKoon, alone or in combination, fail to teach such a process.

Claim 16 has the feature wherein "the ribs have a length in the width direction of the cooling panel of $\leq$ 25% of the width of the panel." As discussed above with respect to claims 4

and 5 in the single rejection over Hille et al., Hille et al. fails to disclose or teach such feature because it teaches of the ribs extending the full width of the plate cooling panel. Applicants additionally submit that McKoon fails to make up for this deficiency.

CONCLUSION

In view of the above, it is respectfully submitted that all rejections are overcome. Thus, a Notice of Allowance is respectfully requested.

Respectfully submitted,

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